(4)

AD-A231 671

DTIC ELECTE FEB 11 1991 S B D

DOCUMENTATION PAGE

Form Approved OMB No 0704-0188

1b RESTRICTIVE MARKINGS

2a SECURITY CLASSIFICATION AUTHORITY

3 DISTRIBUTION / AVAILABILITY OF REPORT
Approved for public release; Distribution Unlimited.

2b DECLASSIFICATION / DOWNGRADING SCHEDULE

4 PERFORMING ORGANIZATION REPORT NUMBER(S)

5 MONITORING ORGANIZATION REPORT NUMBER(S)

6a NAME OF PERFORMING ORGANIZATION
Massachusetts Institute of Technology

6b OFFICE SYMBOL (If applicable)

7a NAME OF MONITORING ORGANIZATION

6c ADDRESS (City, State, and ZIP Code)
Earth, Atmospheric, and Planetary Sciences
77 Massachusetts Avenue
Cambridge, MA 02139

7b ADDRESS (City, State, and ZIP Code)
Office of Naval Research Resident
REPN66017
Massachusetts Institute of Technology
Room E19-678

8a NAME OF FUNDING / SPONSORING ORGANIZATION
Office of Naval Research

8b OFFICE SYMBOL (If applicable)

9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
N00014-90-J-1337

8c ADDRESS (City, State, and ZIP Code)
800 North Quincy Street
Arlington, VA 22217-5000

10 SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO	PROJECT NO	TASK NO	WORK UNIT ACCESSION NO

11 TITLE (Include Security Classification)
Unclassified: Manufacture of Additional External Sensor Packages for the New ONR OBS

12 PERSONAL AUTHOR(S)
Sean C. Solomon

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Final Report	FROM 11/15/89 TO 9/30/90	1 February 1991	5

16 SUPPLEMENTARY NOTATION

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Ocean bottom seismometer

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

The objective of this project was to construct four sensor packages for the ONR ocean bottom seismometer (OBS) system. These units augment 27 sensor packages designed and constructed under a separate ONR-supported subcontract from the Woods Hole Oceanographic Institution (WHOI). The sensor package is a semi-autonomous unit designed to be carried to the seafloor onboard the main ONR OBS frame. Upon landing the package is placed on the bottom by a deployment arm attached to the main frame; when the main instrument is retrieved the sensor unit is recovered as well. The sensor package consists of a housing, a passively gimbaled 3-component array of 1-Hz seismometers, digitally controlled variable gain preamps, and a calibration signal generator. The four sensor packages have been constructed, fully tested, and delivered to the ONR OBS Facility at WHOI.

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT
☒ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS

21 ABSTRACT SECURITY CLASSIFICATION
UNCLASSIFIED

22a NAME OF RESPONSIBLE INDIVIDUAL	22b TELEPHONE (Include Area Code)	22c OFFICE SYMBOL
RANDALL S. JACOBSON	202/ 696-4121	CODE 1125GG

DD Form 1473, JUN 86 Previous editions are obsolete SECURITY CLASSIFICATION OF THIS PAGE

S/N 0102-LF-014-6603

91 2 07 058

FINAL TECHNICAL REPORT

TO THE OFFICE OF NAVAL RESEARCH

ONR CONTRACT N00014-90-J-1337

"Manufacture of Additional External Sensor Packages for the New ONR OBS"

for the period

15 November 1989 - 30 September 1990

Principal Investigator: Sean C. Solomon
Professor of Geophysics
Massachusetts Institute of Technology
77 Massachusetts Avenue, Room 54-522
Cambridge, MA 02139, (617) 253-3786

1 February 1991

MANUFACTURE OF ADDITIONAL EXTERNAL SENSOR PACKAGES FOR THE NEW ONR OBS

Sean C. Solomon
Timothy W. Barash

Department of Earth, Atmospheric, and Planetary Sciences
Massachusetts Institute of Technology
Cambridge, MA 02139
(617) 253-3786

Project Objectives

The objective of this project was to construct four additional sensor packages for the ONR ocean bottom seismometer (OBS) system. The additional units augment the 27 sensor packages designed and constructed under a separate ONR-supported subcontract from the Woods Hole Oceanographic Institution.

Current Status

The sensor package is a semi-autonomous unit to be used in conjunction with an ONR OBS system described elsewhere. The package is designed to be carried to the seafloor onboard the main ONR OBS frame. Upon landing, the sensor package is placed on the bottom by a deployment arm attached to the main frame. When the sensor package contacts bottom, the arm detaches from the sensor package deployment bail and is retracted, leaving the sensor package about 1 m from the main OBS package connected only by cable. When the main instrument package is retrieved the sensor package is recovered as well.

The sensor package consists of a housing, a passively gimbaled 3-component seismometer array, digitally controlled variable gain preamps, and a calibration signal generator. The sensors are Mark Products L4-C 1-Hz seismometers, which are relatively small and sturdy but are also sensitive to low frequency signals of interest. The array is supported by a 2-axis gimbal mechanism (Figure 1) that allows the unit to swing to a level position, regardless of the attitude of the housing package (within 15° of vertical in any direction). This leveling scheme is passive in that no active drive force is applied to the gimbaling mechanism. The gimbaled array is counterweighted and moves into balance at the required level position by means of gravity. The whole gimbaled assembly is immersed in high viscosity oil which allows for the array to attain level status while maintaining an effectively rigid mechanical coupling of the seismometers to the package housing over the seismic passband (above 0.1 Hz).

Power, serial communications, and a calibration clock signal are brought into the sensor package through a 12-conductor cable that is connected to the OBS acquisition package in the main instrument frame. Signal outputs from the variable gain preamps are sent to the acquisition package through the same cable. The gain of each of the three variable-gain preamps can be independently controlled over a range of 54 db in nine 6-db steps. Gain-control information originates in the data acquisition computer (located in the acquisition package) and is delivered to the sensor package through the serial communications link. The calibration signal generator and driver provide a means by which sensor response can be measured in situ. Each seismometer can essentially be "moved" by supplying a small drive current to this coil. The calibration signal is generated locally by a random-telegraph generator that in turn controls a current amplifier that is

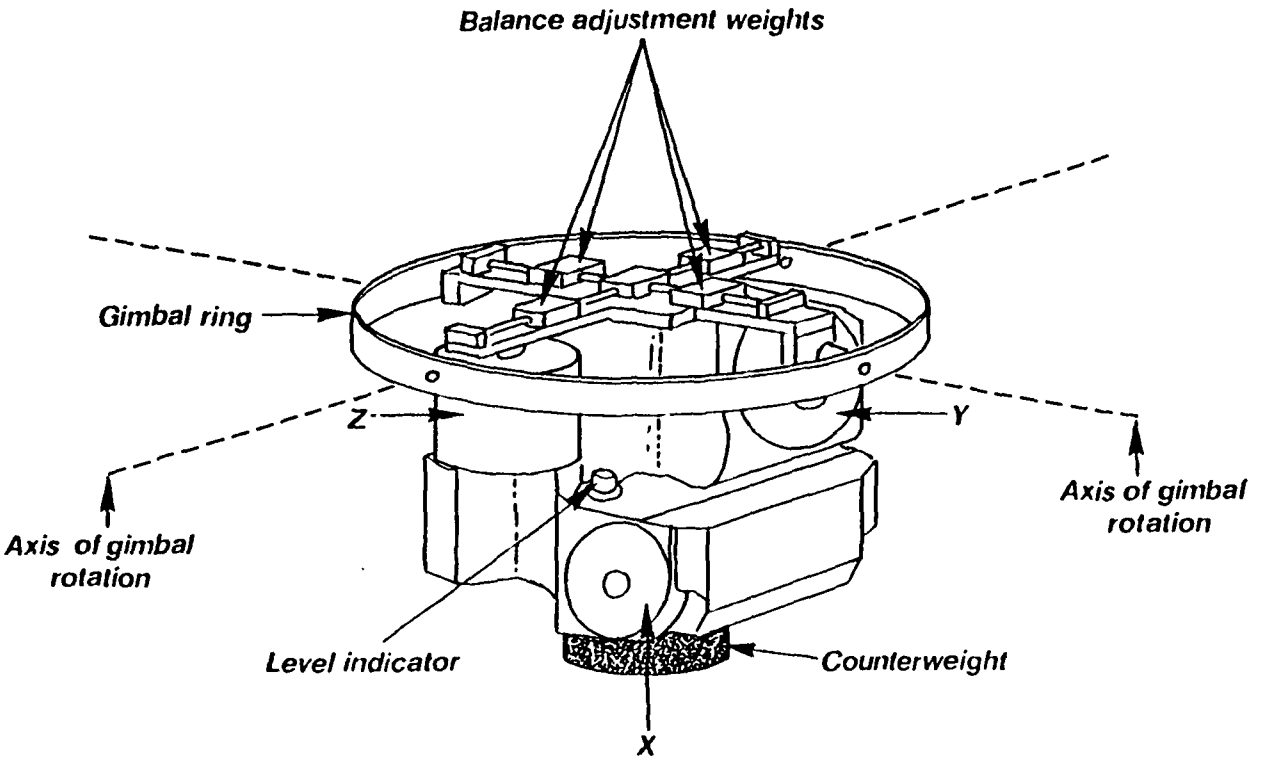

Figure 1. Schematic internal view of the sensor package. X, Y, and Z denote orthogonal seismometers.

connected to the calibration coils. The random telegraph generator is also controlled by the acquisition package through the serial link.

The package housing consists of upper and lower hemispheres approximately 31 cm in diameter separated by an equatorial ring approximately 5 cm in height (Figure 2). The housing sits upright and is fastened to a 50-cm-diameter fiberglass base-plate that has coupling fins attached to its bottom. This base-plate configuration is suitable for use in soft sediments. Alternative base coupling structures can easily be attached to the sensor package as required. A semicircular deployment bail that is attached to the equatorial ring is used for package deployment and recovery. The cable from the acquisition package is attached to a connector that is located at the top of the upper hemisphere.

The housing is fabricated out of 7075-T6 aluminum alloy and is designed to withstand external pressures at a depth of 7000 m. The outside of the housing is hard-coat anodized (Sanford process) and is painted with an epoxy-based paint. The application of sacrificial zinc anodes to the housing provides additional protection from sea water corrosion. The sensor package unit, including the baseplate and deployment bail, weighs 37.5 kg in air and 16.3 kg in sea-water.

The four sensor packages have been constructed, fully tested, and delivered to the ONR OBS Facility at WHOI.

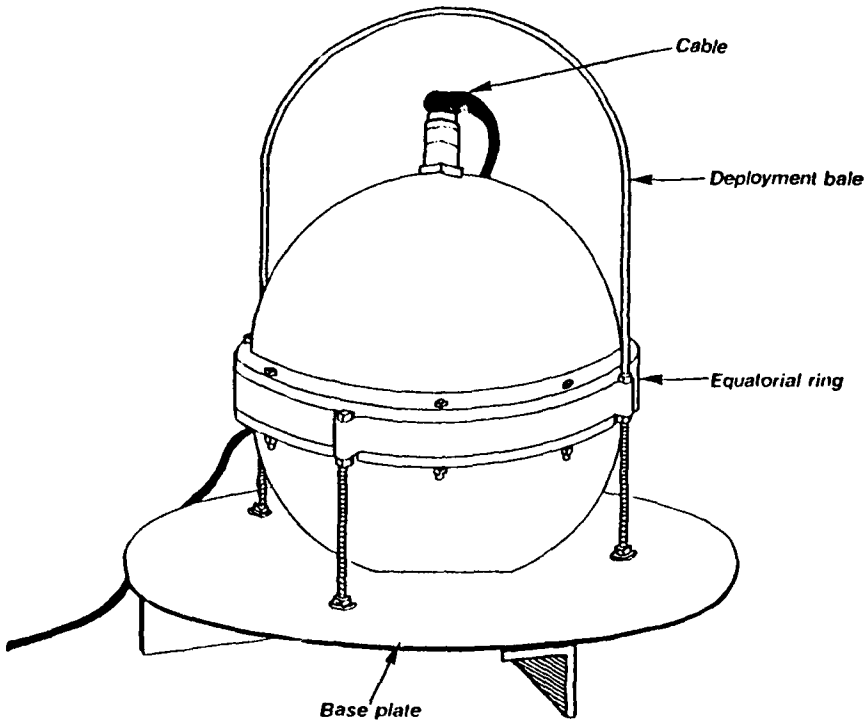

Figure 2. Schematic external view of the sensor package.